Berita Kedokteran Masyarakat
Vol. 24, No. 4, Desember 2008
halaman 212 - 217

A STUDY ON HYPERTENSION AMONG POPULATION LIVING UNDERNEATH SUTETI AND ITS RELATED FACTORS JAKARTA 2009

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ABSTRACT

Background: Hypertension is one of the degenerative diseases which killed about 7,2 mill people, about 13 % of the total death worldly. In Indonesia the disease has become more popular, It was reported that Indonesia had got a quite high prevalence of hypertension , among male 24,9%, female 23,6% , elderly 33,3 % , SUTETI 500 kV is the Extra High Electrical Energy Transmission lines transferring the energy from the Electrical Power Installation to the consumers via the connection of Power Relay station. The SUTETI electromagnetic exposure many times has been connected with diseases and mental emotional disorders used to be experienced by patients with hypertension such as head ache, dizziness, easily get angry, heavy neck as well as stroke. These health disturbances have been considered by many people as SUTETI's negative health impact among people living underneath. Most of the times were used by public as the major reasons against the installation of SUTETI wire network.

Method: The aim of study is to identify the relation between SUTETI exposure and hypertension, and its related factors among population living underneath. Another objective of study is to identify the relation between mental emotional factors and hypertension. The population was people living underneath SUTETI 0-100 ms right and left away from the towers. The number of samples collected was about 2000 people with the calculated sample size 753 and were stratified into three zones, zone 1 , 0-30 ms right and left from the tower, zone 2 , 30-70 ms and zone 3 ,70-100 ms. The independent variables were sociodemographic factors i.e., age, sex, education, income , length of stay at home, duration of stay at the location, besides smoking habit, annoyance, satisfaction, electrical field dose , magnetic field dose and zone . Blood chemistry examined were cholesterol and nutritional status besides melatonin, mental emotional and sleeping disorders.

Result and conclusions: Study results reported that the highest outside the house measurements of the electric field was in zone 1 , 3,2 kV/m and magnetic field was 6,7 X 10^{-2} mT , both were still lower than the National Standard of SUTETI in Indonesia – SNI 2003 , 5 kV/m and 0,1 mT. The prevalence of hypertension based on zone were significant , zone 1, 14,14%, zone 2 , 11,31% and zone 3, 5,66 % (p = 0,004) The logistic regression function analysis identified two determinants, duration of stay (p = 0,044) ; OR 3,85 (95 %CI :1,04 – 14, 12) ; income (p = 0,019 , OR 15, 891 (95% CI: 1,578 – 169,97). People living > 30 years under the SUTETI towers (0 – 100ms) will be risky 3,85 times to get hypertension than people living less than 30 years. Also people with less income had the risk 16 times to get hypertension compared to middle income. The results did not reveal any specific evidence of association between the electromagnetic exposure and hypertension. The logistic regression function also did not identify any association between mental emotional disorders and sleeping disorders towards hypertension.

Keywords: hypertension, SUTETI, mental emotional disorders

INTRODUCTION

Hypertension or high blood pressure (BP) is one of the major degenerative diseases which was estimated to cause 7,2 mill death worldly, about 13% of the total death yearly, and Indonesia has got a quite high prevalence of hypertension, among male 24,9% and female 23,6%.[1] The prevalence of hypertension in rural and urban areas in Indonesia according to Minister of Health, 2007 about 17%–21%.[2] Among elderly the prevalence is quite high 33,3%.[3]

Varies factors were considered as the risk factors i.e., lifestyle, smoking habit , less exercise , unbalanced diet , stress and varies related disease such as renal disturbance beside the genetic factor. About 90 % of hypertension patients were classified as the essential hypertension with unidentified cause.[1]

Hypertension is one of the diseases with subjective clinical symptoms commonly being classified as the mental emotional group or the psychosomatic disorders. For lay people patients, without measuring the blood pressure by doctors, most of the time they will consider the symptoms as mental emotional disorders.

SUTETI 500 kV is the Extra High Electrical Energy Transmission lines transferring the energy from the Electrical Power Installation through the Power Relay Station being distributed to the consumers. The SUTETI electromagnetic exposure , many times is being connected to diseases and mental emotional disorders disorders used to be

experienced by patients suffering hypertension such as headache, dizziness, easily get angry, sleeping disturbance, heavy neck , as well as stroke . These health disturbances have been considered by many people as SUTETI'S negative health impact being used as the major reasons for public against the installation of SUTETI wire network.

The aim of study is to identify the relation between SUTETI exposure and hypertension, and its related factors among population living underneath SUTETI towers. Another objective of study is to identify the relation between mental emotional disorders and hypertension.

METHOD

The design of study is cross sectional, the location of study is Jakarta and Bekasi , population was people living underneath SUTETI towers have been living there for morethan 15 years. About 1500 respondents (the minimal calculated sample size was 753) were sampled proportionally from three zones of subpopulations ; zone 1, 0-30 meters away from the right and left handside of the middle of tower foot, zone 2 , 30 – 70 meters and zone 3 , 70 -100 meters. Respondents were sampled based on household and about 1733 adults were examined their blood pressure by doctors through physical examinations. The hypertension was stated using WHO measurement[1], sitting position after resting at least 5 minutes , three times measurements with interval 3 minutes consecutively. The average systolic blood pressure)SBP) > = 140 mmHg , diastolic blood pressure(DBP) > = 90 mm Hg.

The independent variables were sociodemographic factors i.e., age, sex, education, income, length of stay at home, duration of stay at the location, besides smoking habit, annoyance, satisfaction, electrical field dose, magnetic field dose and zone. Blood chemistry examined were cholesterol and nutritional status besides melatonin, mental emotional disorders and sleeping disorders. Annoyance measuring the respondent's feeling of being annoyed living underneath SUTETI and the reasons while satisfaction measuring the feeling of satisfaction living in the location. Melatonin was measured at night time examined from saliva using the method of Elisa, Buhlman Version 2005-05-25-ALPCO 06-01-05 , the unit of measurement pg/ml.[4] The production of melatonin was assumed being pressured by the SUTETI electromagnetic exposure.

Beside the measurement of environmental electromagnetic exposure outside the houses using Holoday apparatus[5], the electrical field dose and magnetic field dose were measured for each individual. The electrical and magnetic field dose were the function of length of stay at home per day of each individual and the electric and magnetic field at home measured, one meter from the ground with the lamps were on The descriptive, bivariate and logistic regression functions were used in the statistical analyses.

RESULTS AND DISCUSSCIONS

SUTETI is popular as the Power Line frequency produces the electromagnetic field with the intensity of 50-60 Hz categorized the Extremely Low Frequency group (0 – 10000 Hz) in the electromagnetic spectrum of wavelength. The health hazard was non thermal with low induced current.[6]

The electric fields as well as the magnetic field outside the house measured were skewed to the right with the highest at the first zone. Both were still less than the Indonesian National Standard or SNI 2003 of SUTETI [7]for environmental power field electromagnetic , 5 kV/m and 0,1 mT (milli Tesla). The results were similar to Djoko's findings,1996.[8] The outside measurement of the electromagnetic field reflects closely the exposure of SUTETI.

This result showed that the electromagnetic field of SUTETI has got the peak at the range of 0-30 m become lesser and lesser until closer to zero at the distance of 100 meters. The electric and magnetic field inside house were both also much smaller than the National Standard of powerline for public, 5 kV/m , 0,1 mT. The electromagnetic field were very small due to the 'shielded' characteristic of the electric

Table 1. Distribution of inside and outhouse electric and magnetic field, among zones

Variables	zone			p
	1	2	3	
- Electric field outside house	3,2 kV/m	0,5 kV/m	0,01 kV/m	p = 0,010
- Magnetic field outside house	6,7 X 10-²mT	1,3 x 10-²mT	6,3 x 10-²mT	p = 0,000
- Electric field inside house	179,10V/m	102,22 V/m	53,29V/m	p = 0,010
- Magnetic field	13,82x10-² mT	6,22 x 10-² mT	3,38x10-²mT	p = 0,000

field, in which the electric field will be reduced if being contacted with any isolater such as roof, building walls etc,[6]

According to the Ecological Theory of Gordon[9] if the agent in this case SUTETI exposure is still below the normal standard than there will be no hazardous reaction of body or disorders may happen. This concept has been used widely by the electro/ Powerline scientist technicians in the world as well as in Indonesia. The electromagnetic field of SUTETI will be monitored and as long as the measurement results are still below the threshold adapted, they will consider no harmful effect to human will happen.

Table 2. Distribution of % respondents based on education, age and socio Economic level, duration of stay in location, among zones

Variables	zone			p
	1	2	3	
1. Hypertension	14,14	11,31	5,66	p = 0,004
2. Socio economic				
- < Rp. 425.000	32,95	24,98	30,98	p = 0,884
3. Age				
- < 30	7,91	5,65	7,50	p = 0,833
4. Education				
- Low	35,31	25,74	31,39	p = 0,351
5. Sex				
- men	17,88	13,44	16,09	p = 0,881
6. Duration of stay				
- > 30 years	13,67	7,96	10,33	p = 0,012

Table 2 reported the prevalence's of hypertension among zones, zone 1, 14,14%, zone 2, 11,31% and zone 3, 5,66% , and there were significant differences exist among zones (p = 0,004). Those prevalence's, even in zone one is less than the normal prevalence of Indonesia 23%–24% reported.[1]

The results showed that the prevalence of hypertension among people underneath SUTETI is less than the prevalence in normal population.

The descriptive statistical analyses also reported about the socioeconomic status measured by income, there is no significant difference among zones; the three zones were dominated by low socioeconomic level or poor. Zone 1, the poor strata < Rp425.000,00 monthly 32, 95%, zone 2 , 24,98% and zone 3 30,98 %. Age was identified not significant among zones dominated by adult, while education was also dominated by low level of education.

About the duration of stay, 31,96% were living more than 30 years underneath SUTETI , the bigger proportions lived in zone 1 and zone 3.

Table 3 reported that satisfaction, annoyance and CMI were significant. Different identified among zones. All three variables showed the highest percentage in zone 1 especially annoyance and mental disorders. Mental disorders was reported as being the nearer to the tower the bigger the percentage. The percentage of feeling not satisfied is quite small, the smallest in zone 1. There is always the small group which was not satisfied living underneath SUTETI while annoyance is quite high in the first zone. The latter could be explained by the reasons identified such as the possibility of tower collapsing , the wire break off, burning of test pen, electric shock, corona as well as the damages of electronic devices at home and in the mosques/ *mushollah*. The highest percentage of mental emotional disorders could also be related to those reasons.

Table 3. Distribution of respondents' percentages based on smoking habit, Cholesterol, nutritional status, satisfaction, annoyance, CMI, Sleeping disorder and melatonin among zones,

Variables	zone			p
	1	2	3	
1. Smoking habit				
- Smoking habit yes	20,24	18,42	6,27	p = 0,089
2. Cholesterol				
- Nor normal	23,58	21,88	19,77	p = 0,061
3. Nutritional status				
- Obesity	18,31	1`,21	26,05	p = 0,312
4. Satisfaction				
- Not satisfied	4,51	3,29	3,75	p = 0,006
5. Annoyance				
- annoyed	30,70	21,98	25,22	p = 0,003
6. Mental disorders/CMI				
- Yes	20,41	13,61	8,59	P = 0,000
7. Sleeping disorders				
- Yes	19,03	14,66	16,75	p = 0,473
8. Melatonin				
- < med (low production)	18,25	14,91	17,77	p = 0,665

The logistic function regression analyses[10]

The bivariate analyses of hypertension

The variables were: age, sex, education, income, smoking habit, satisfaction, and annoyance, duration of stay in location, cholesterol, melatonin, electric field dose, magnetic field dose, nutritional status, CMI and sleeping disorders. The variables used in the predicted model with ps < 0,25 were : cholesterol (p = 0,031); magnetic dose (p = 0,005); nutritional status (p =0,000); duration of stay (p = 0,000) income (p =0,000). The last model of hypertension, the fitting of the model, p =0,000 , R square 0,483 with determinants identified were duration of stay (p = 0,044); OR 3,85 (95 %CI :1,04 – 14,12) ; income (p = 0,019, OR 15, 89 (95% CI 1,58 – 169,97). People living > 30 years under the SUTETI towers (0 – 100ms) will be risky 3,85 times to get hypertension than people living less than 30 years. This result could be clarified by people who have been living > 30years are becoming elderly which in the normal population has got the highest prevalence, 33,3%.[3]

People with low income have the risk to get hypertension 16 times compared to moderate income. The population of study was mostly low income strata in which the poor living condition strongly colored their lives. It was reported that hypertension occurs among all strata, among poor people the consuming of, unhealthy daily cheap food (e.g. Salty fish, greasy food etc) is the triggering exogenous factor for suffering hypertension.

These study results did not reflect any specific evidence of association between the electromagnetic exposure and hypertension. Both electric field dose and magnetic field dose were proven not identified as determinants of hypertension.

This is also synchronized the measurements of the low electromagnetic field in that area, the electric field as well as the magnetic field both were below threshold values, 5 kV/m , 0,1 mT, (See Table2)

In this case smoking habit as well as the other independent variables such as cholesterol , nutritional status, annoyance , satisfaction . melatonin as well sleeping disorders were not related to hypertension.

The relation between the exposure of electromagnetic field and hypertension could be considered as the short term effect as well as the long term effects. For short term effect several studies such as Hauf[1]? reported in his study among subjects being exposed to a 50 Hz field (20 kVm^{-1} and 0,3 mT) with a current of 500 µA passing through the body, no blood pressure change observed. Korpinen & Partanen, 1996[1]? reported their study on human exposed 1 hour to EMFs under 50 Hz , 350-430 kV/m, 1,4-6,6 µT within one hour, no change observed in blood pressure. Chokroverty et al ??, 1995 reported their study results on magnetic brain stimulation among persons exposed to pulsed magnetic fields up to 2,2 microT, with no changes happened in the blood pressure. In the long-term effect, several studies Sastre, Cook and Graham 1998[1]? reported that their experiment in a double blind laboratory investigation which exposure to 20 micro T of intermittent 60 Hz magnetic field was found to reduce the normal variation of Heart Rate Variability/HRV. This finding, in subsequent studies among volunteers did not always produce consistent results regarding HRV and exposures to magnetic fields. Graham et al [16], 2000 in the multistudy analysis concluded that differences in study design factors related to physiologic arousal might explain the inconsistency.

Hakansson et al ? also reported the association between occupational exposure to EMF and cardiovascular disease. This study has its limitation due to relying on mortality records as the measure of outcome and death certificates which is known with many incumbent limitations. The sources of data harm the accuracy of diagnosis A recent study by Mant et al[18] identified those inaccuracies in identifying the underlying cause of death on death certificates and difficulties on differentiating between acute and chronic cardiac causes.

Another studies for long term effects, Checcucci[19] found no effect on the cardiovascular system in 1200 workers at high voltage railway station. Also Baroncelli et al,[20] identified the similar results, no significant difference of ECG between the exposed and control groups among railway high voltage substation workers survey.

The Environmental Health Criteria 238, 2007[21] stated that experimental studies of both short and long term exposure indicate that beside the electrical shock, no other hazardous cardiovascular included change of blood pressure / hypertension associated with ELF field are unlikely to occur at exposure levels commonly encountered environmentally and occupationally. Although various cardiovascular diseases have been reported in the literature but the effects are small and not consistent, included the

long-term effects reporting through the cohort studies of morbidity and mortality. As a whole the evidence does not not support any association between ELF/ Power line 50-60 Hz exposure and cardiovascular disease as well as hypertension.

The study results in the bivariate as well as in the logistic regression function did not reveal any correlation between mental emotional disorders and hypertension. It was reported that mental disorders/ CMI were significant different identified among zones: zone 20,41%, zone 2, 13,61% and zone3 8,59% (P = 0,000) but in the bivariate analyses CMI (p = 0,365) was not significant related to hypertension. The results proved that people with mental emotional disorders have no relation with having hypertension. The prevalence of mental emotional disorders showed the highest in the first zone, the farther the lesser assuming be related to the annoyance and the reasons of annoyance. If the reasons of annoyance such as electric shock and device damage be handled well through proper grounding, most possible might reduce the annoyance as well as mental emotional disorders. [21]

The findings answer the question raised about the relation between hypertension and mental emotional disorders as well as sleeping disorders. In other words among the population living underneath SUTETI, no relation between mental emotional disorders / sleeping disorders and hypertension.

The hypertensive patients should be stated based on blood pressure measurements and treated by considering the medical and risk factors while the mental emotional patients should be treated differently based on the specific risk factors such as annoyance and satisfaction. Patients could be very easily being separated through measuring his/hers systolic and diastolic blood pressure.

CONCLUSIONS AND RECOMMENDATIONS

The measured electromagnetic field power in this study i.e., the electric field and magnetic field were both less than the threshold values recommended , 5 kV and 0,1 mT. The prevalence/ proportions of hypertension based on zones were significant different (p = 0,004) , zone 1 ,14,14%; zone 2, 11,31% and zone 3, 5,66% , these were smaller than the normal population 23-24% recorded. The determinants of hypertension identified were duration of stay; OR 3,85 (95 %CI :1,04 – 14,12) , people living > 30 years under the SUTETI towers (0 – 100ms) will be risky 3,85 times to get hypertension than people living less than 30 years and income, OR 15, 89 (95% CI 1,58 – 169,97), people with low income have the risk to get hypertension 16 times compared to moderate income. No association found between mental emotional disorders, sleeping disorder and hypertension

People living underneath Suteti needs proper and continuing education about the information on no relation exist between hypertension with the exposure of the electromagnetic power Suteti as well as mental disorders. Community Development is recommended for people living underneath. Suteti due to low socioeconomic strata i.e., poor condition. The community development should include the regular monitoring of the electromagnetic field as well as nutritional educational program and providing inexpensive medical service.

ACKNOWLEDGEMENT

The study has been completed thoroughly, thanks to the collaborations of these institutions and personnel's as follows : The consultants physicians / medical specialists who trained the medical doctors with specific knowledge for conducting physical examinations before the study in the field Department of Child Health RSCM Jakarta, Department of Neurology RSCM Jakarta, Department of Heart /Cardiovascular , RS Dharmais , Jakarta, Department of Pulmonology, RS Fatmawati, Jakarta, Others, RSCM Jakarta. The Institute of Technology Bandung/ITB for the collaboration of the electromagnetic field work as well as the mapping for respondent's recruitment underneath Suteti. The Department of Community Medicine (IKK FKUI) staffs for developing and validating the questionnaires. The ITB and IKK FKUI staffs collaborations for training the surveyors for data collection. The MAKMAL Institute, RSCM for melatonin lab examination The RSCM Clinical Pathology laboratory for blood chemistry lab exams. The ECG Specialist and Pulmonologist from Dharmais and Fatmawati Hospitals for reading and interpreting the results. With special thanks to the Magister Program of Occupational Medicine allowing the participants doctors to collect data and physical examinations. Last but not least special thanks also

were conveyed to the chiefs of Sub districts, Hamlets, RWs, RTs and people living underneath of SUTETI towers in East Jakarta and Tambun for participating in the study and the head of families for informed consent.

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